3.0 ENVIRONMENTAL ANALYSIS

3.1 APPROACH

The process used by the study team (see Section 9.0 List of Preparers) to analyze the potential environmental impacts of the alternatives evaluated in the DEIS was also followed for the additional alternatives investigated in this FEIS. A detailed discussion of this method, along with accompanying diagrams, is presented in Section 3.1, Approach, of the DEIS.

As in the DEIS, Section 3.0, Environmental Analysis, of this FEIS has been structured primarily according to environmental components or resources (i.e., soils/geology, surface water, air). An explanation of the organization of each environmental resource section of this FEIS is provided in Section 3.2 below.

3.2 DAM, RESERVOIR, AND RAW WATER TRANSMISSION MAIN

This section has been organized according to environmental components, or resource areas in the same order as appeared in the DEIS. No new resource areas have been added for the FEIS.

Four alternatives, three dam and reservoir sites and the No Action alternative, were investigated in each resource section in the DEIS. The three dam and reservoir alternatives that were analyzed included the War Fork and Steer Fork site, with an average yield of 3.5 mgd, the Sturgeon Creek, 8.5 mgd site, and the Sturgeon Creek, 3.5 mgd site. Due to the revision of the projected water needs for Jackson and surrounding counties, and a subsequent reassessment of alternatives eliminated from further study in the DEIS, four additional alternatives were determined to be reasonable for further consideration in this FEIS.

As noted in Section 1.1, The Environmental Impact Statement, of this FEIS, this FEIS incorporates the Jackson County Lake Project DEIS by reference, and contains only new information obtained and additional analyses conducted since the publication of the DEIS. This FEIS is organized according to the same section numbers and headings as presented in the DEIS. Where there is additional information for a section originally presented the DEIS, or where additional analyses have been made, this information is presented in the text of the FEIS under the appropriate section heading. Where a section that was present in the DEIS contains no additional information for the FEIS, this fact is stated under that section heading. In all sections of the FEIS, the information contained in the DEIS is incorporated by reference.

Additional section numbers and headings have been added to the text of the FEIS for the evaluation of additional alternatives. The new section numbers follow consecutively the section numbers presented in the DEIS, and thus, are introduced after all sections from the DEIS are presented. Due to this order of presentation, there are now two sections for each resource area entitled “Summary of Impacts.” The first section with this title refers to the evaluation of

alternatives in the DEIS, and contains the same section number as presented in the DEIS. The second section with this heading contains a summary of environmental impacts of the additional alternatives evaluated in this FEIS.

Each resource section in the DEIS contains information on the affected environment, environmental consequences, and mitigation measures for each component of the proposed action: the construction and operation of a dam and reservoir and the construction of a raw water transmission main. These two components are separately discussed throughout each resource area of the DEIS, where possible, and are delineated by subheadings. This format is retained for the FEIS. Since two of the additional alternatives investigated in this FEIS are in the form of pumped storage, which involves only the construction of a water transmission pipeline, not a reservoir, discussions of the common aspects of the affected environment and environmental consequences of these alternatives are presented under the Raw Water Transmission Main subheadings.

Within each resource section of the FEIS, you will find the following structure:

- **Affected Environment**
  - Describes the relevant aspects of the current condition of that resource that are common to all alternative project locations
  - Only new or changed information concerning the current resource condition is presented in this section of the FEIS

  - **War Fork and Steer Fork**
    - Distinguishes the aspects of the current resource condition specific to the War Fork and Steer Fork (3.5 mgd) reservoir site
    - Only new or changed information concerning the current resource condition is presented for this alternative in the FEIS

  - **Sturgeon Creek, 8.5 mgd**
    - Distinguishes the aspects of the current resource condition specific to the Sturgeon Creek, 8.5 mgd reservoir site
    - Only new or changed information concerning the current resource condition is presented for this alternative in the FEIS

  - **Sturgeon Creek, 3.5 mgd**
    - Distinguishes the aspects of the current resource condition specific to the Sturgeon Creek, 3.5 mgd reservoir site
    - Only new or changed information concerning the current resource condition is presented for this alternative in the FEIS

  - **War Fork and Steer Fork, 1.3 mgd**
    - Distinguishes the aspects of the current resource condition specific to the War Fork and Steer Fork, 1.3 mgd reservoir site

- **War Fork and Steer Fork, 2.2 mgd**
  - Distinguishes the aspects of the current resource condition specific to the War Fork and Steer Fork, 2.2 mgd reservoir site

- **Wood Creek Lake Pipeline**
  - Distinguishes the aspects of the current resource condition specific to the pipeline route from Wood Creek Lake to the Jackson County Water Association (JCWA) Treatment Plant

- **Lock 14 Pipeline**
  - Distinguishes the aspects of the current resource condition specific to the pipeline route from Lock 14 of the Kentucky River to the JCWA Treatment Plant

- **Environmental Consequences**
  - A list of the potential effects on that resource, regardless of project location or alternative
  - Analysis of which potential effects, common to all alternatives, are actually predicted by the study team to occur, and to what degree
  - Only new or changed information concerning the common potential effects of all alternatives is presented in this section of the FEIS

  - **War Fork and Steer Fork**
    - Analysis of the potential effects that are predicted by the study team to occur specifically at the War Fork and Steer Fork (3.5 mgd) project site
    - Only new or changed information concerning the potential effects is presented for this alternative in the FEIS

  - **Sturgeon Creek, 8.5 mgd**
    - Analysis of the potential effects that are predicted by the study team to occur specifically at the Sturgeon Creek, 8.5 mgd project site
    - Only new or changed information concerning the potential effects is presented for this alternative in the FEIS

  - **Sturgeon Creek, 3.5 mgd**
    - Analysis of the potential effects that are predicted by the study team to occur specifically at the Sturgeon Creek, 3.5 mgd project site
    - Only new or changed information concerning the potential effects is presented for this alternative in the FEIS

  - **No Action**
    - Analysis of the potential effects that are predicted by the study team to occur if no action took place, and the project did not proceed
    - Only new or changed information concerning the potential effects is presented for this alternative in the FEIS

- **Summary of Impacts**
  - Summary of all impacts predicted to occur on the resource area from alternatives investigated in the DEIS only, which include the War Fork and Steer Fork (3.5 mgd) alternative, the Sturgeon Creek, 8.5 mgd and 3.5 mgd alternatives, and the No Action alternative

- **War Fork and Steer Fork, 1.3 mgd**
  - Analysis of the potential effects that are predicted by the study team to occur specifically at the War Fork and Steer Fork, 1.3 mgd project site

- **War Fork and Steer Fork, 2.2 mgd**
  - Analysis of the potential effects that are predicted by the study team to occur specifically at the War Fork and Steer Fork, 2.2 mgd project site

- **Wood Creek Lake Pipeline**
  - Analysis of the potential effects that are predicted by the study team to occur specifically along the pipeline route from Wood Creek Lake to the JCWA Treatment Plant

- **Lock 14 Pipeline**
  - Analysis of the potential effects that are predicted by the study team to occur specifically along the pipeline route from Lock 14 of the Kentucky River to the JCWA Treatment Plant

- **Summary of Impacts**
  - Summary of all impacts predicted to occur on the resource area from the additional alternatives investigated in the FEIS only, which include the War Fork and Steer Fork, 1.3 mgd and 2.2 mgd alternatives, the Wood Creek Lake pipeline, and the Lock 14 pipeline

- **Mitigation Measures (as appropriate)**

3.2.1 GEOLOGY/SOILS

There are no changes to this section for the FEIS. Please refer to Section 3.2.1, Geology/Soils, of the DEIS.

3.2.1.1 Affected Environment

All of the proposed dam and reservoir sites lie within the eastern portion of Jackson County. Section 3.2.1.1, Affected Environment, of the DEIS discusses the aspects of geology, topography, and soils that are common to all proposed reservoir sites. One of the references for Table 3.2.1-1, Soil Types and Characteristics at the Proposed Project Sites, in the DEIS was stated to be (NRCS, 1983). The date on this reference is inaccurate, and should read 1989. This has been changed in Section 8.0, References Cited, of this FEIS. There are no other changes to this section for the FEIS.

As discussed in Section 3.2.8, Land Use, of the DEIS, prime farmland soils, as defined by the United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), are soils that are best suited for producing food, feed, forage, fiber, and oilseed crops. They produce the highest yields with minimal energy and economic resource input (NRCS, 1989).

Soils classified by NRCS as prime farmland may be currently in use as cropland, pasture, woodland, or another use. These soils are used for producing food or fiber, or are available for these uses. However, in certain settings, soils that are typically concerned prime farmland by the NRCS cannot be classified as prime farmland. These settings include urban or built-up land (any contiguous unit of ten acres or more that is used for purposes such as housing, industrial, and commercial sites, public buildings, cemeteries, railroad yards, etc.), public land, and water areas. Public land is not available for farming in national forests and parks, military reservations, and state parks (NRCS, 1989).

Table 3.2.1-3 below presents the soil types present in Jackson County that are classified by NRCS as prime farmland soils. More information on these soil types is presented in Table 3.2.1-1 of the DEIS.

Table 3.2.1-3. Soil Types in Jackson County Classified as Prime Farmland

Soil Symbol	Soil Type
AvB	Allegheny Variant silt loam, 2 to 6 percent slopes
GpB	Gilpin-Rayne silt loams, 2 to 6 percent slopes
Gs	Grigsby fine sandy loam, 0 to 3 percent slopes, frequently flooded (where protected from flooding or not frequently flooded during the growing season)
Gv	Grigsby-Orrville Variant complex, 0 to 3 percent slopes, frequently flooded (where drained & protected from flooding or not frequently flooded during the growing season)
Hu	Huntington loam, 0 to 4 percent slopes, occasionally flooded
Ro	Rowdy silt loam, 0 to 4 percent slopes, occasionally flooded

Source: NRCS, 1989.

3.2.1.1.1 War Fork and Steer Fork

As discussed in Section 3.2.1.1.1, War Fork and Steer Fork, of the DEIS, there approximately 29 acres of prime farmland within the area of the maximum flood level and the 300-foot buffer surrounding the normal pool of the proposed reservoir at the War Fork and Steer Fork, 3.5 mgd site. All of these soils are of soil type Gs (refer to **Table 3.2.1-3** above). While this soil type is classified as prime farmland by the NRCS, since it is currently public land within the Daniel Boone National Forest (DBNF), it cannot be considered as prime farmland (NRCS, 1989).

There are no other changes or additions to this section for the FEIS. Refer to Section 3.2.1.1.1, War Fork and Steer Fork, of the DEIS for a discussion of the affected environment for this alternative.

3.2.1.1.2 Sturgeon Creek, 8.5 mgd

There are no changes to this section for the FEIS. Refer to Section 3.2.1.1.2, Sturgeon Creek, 8.5 mgd, of the DEIS for a discussion of the affected environment for this alternative.

3.2.1.1.3 Sturgeon Creek, 3.5 mgd

There are no changes to this section for the FEIS. Refer to Section 3.2.1.1.3, Sturgeon Creek, 3.5 mgd, of the DEIS for a discussion of the affected environment for this alternative.

3.2.1.1.4 War Fork and Steer Fork, 1.3 mgd

Dam and Reservoir

The proposed War Fork and Steer Fork, 1.3 mgd reservoir would cover an estimated 65 acres at the normal pool elevation of 946 feet. About 215 acres would be required for the combined area up to maximum flood level and a 300-foot buffer surrounding the normal pool of a reservoir at this site (Kenvirons, 2000b).

Geology

The geology at the proposed War Fork and Steer Fork, 1.3 mgd dam and reservoir site is primarily Breathitt and Lee Formations with sandstone members, underlain by the Pennington Formation and Newman Limestone, in descending order. Unconsolidated alluvium occurs in some stream channels (Weir, 1973).

The Breathitt and Lee Formation in this area is composed mostly of shale, with smaller portions of siltstone, sandstone, and coal seams. The base of the Breathitt Formation lies at between 950 and 1,000 feet above mean sea level (MSL) in the area of the proposed War Fork and Steer Fork, 1.3 mgd project site. It is at least 480 feet thick. The Pennington Formation is composed mostly of shale (80 percent) with some siltstone (10 percent), sandstone (10 percent), and minor dolomite (dolostone). The unit forms a moderate slope. This formation is only fully-exposed on

the lower slopes of War Fork and its tributaries and the lower part of Lake Creek. It is between 35 and 110 feet thick. Sandstone members range from 0 to 35 feet thick. Newman Limestone is 90 percent limestone and 10 percent shale. This formation is only fully-exposed in the segment of War Fork north of the Turkey Foot Campground.

Topography

The topography within the maximum flood level of the proposed War Fork and Steer Fork , 1.3 mgd reservoir is steep, with most slopes ranging from 5 to greater than 10 percent slope. The valley floor is approximately 375 feet across at the base of the proposed War Fork and Steer Fork, 1.3 mgd dam site.

Soils

Two soil types are present within the boundaries of the proposed War Fork and Steer Fork, 1.3 mgd project site. These soil types are Shelocta-Gilpin (SgF) and Grigsby (Gs). Table 3.2.1-1, Soil Types and Characteristics at the Proposed Project Sites, in the DEIS provides information on these soil types. Acreages listed in this table are for the War Fork and Steer Fork, 3.5 mgd site that was discussed in the DEIS. These acreages would be smaller for the War Fork and Steer Fork, 1.3 mgd site. In addition, the amount of prime farmland soils present within the proposed War Fork and Steer Fork, 1.3 mgd reservoir, up to maximum flood level, and with a 300-foot buffer surrounding the normal pool of the reservoir, would be equal to or slightly less than the estimated 29 acres for the War Fork and Steer Fork, 3.5 mgd site discussed in Section 3.2.1.1.1 of the DEIS. All of these prime farmland soils are of soil type Gs (refer to **Table 3.2.1-3** above). While this soil type is classified as prime farmland by the NRCS, since it is currently public land within the DBNF, it cannot be considered as prime farmland (NRCS, 1989).

Raw Water Transmission Main

The raw water transmission main leading from the proposed War Fork and Steer Fork, 1.3 mgd reservoir would run about 8.9 miles to the JCWA Treatment Plant. All but approximately one mile of the route would run alongside existing roadways, mostly in the Kentucky Department of Transportation (KDOT) or County rights-of-way (ROW). ROW would need to be obtained in the form of a Special Use Permit from the U.S. Forest Service (USFS) for National Forest jurisdiction roads F.S. 3109 Turkey Foot Road. In addition, for the portion of the proposed water main route that would not travel alongside existing roadways, ROW easements would likely need to be obtained from adjoining private landowners. Most of the route would be within the Gilpin-Shelocta-Rayne soil unit, discussed in Section 3.2.1.1, Affected Environment, of the DEIS. The general characteristics of the geology and topography along this route are similar to those of the War Fork and Steer Fork, 1.3 mgd dam and reservoir site, discussed above.

3.2.1.1.5 War Fork and Steer Fork, 2.2 mgd

Dam and Reservoir

Since the boundaries of the War Fork and Steer Fork, 1.3 mgd project site lie entirely within those of the War Fork and Steer Fork, 2.2 mgd project site, aspects of the geology, topography, and soils present within the project areas would be the same. Please refer to Section 3.2.1.1.4 above for this information.

Raw Water Transmission Main

Since the route for the raw water transmission main leading from the proposed War Fork and Steer Fork, 2.2 mgd reservoir would be the same as that leading from the proposed War Fork and Steer Fork, 1.3 mgd reservoir, aspects of the geology, topography, and soils along the route would be the same. Refer to Section 3.2.1.1.4 above for this information.

3.2.1.1.6 Wood Creek Lake Pipeline

The Wood Creek Lake water transmission pipeline would be constructed from the existing Wood Creek Water District 20-inch transmission main on Filter Plant Road, just east of Wood Creek Lake. The entire length of the pipeline would follow alongside existing roadways in the KDOT or County ROW. The transmission pipeline would continue northeast on Filter Plant Road, turning southeast alongside US 25. The pipeline would follow alongside US 25 to Dean Hundley Road. The transmission main would run northeast alongside Dean Hundley Road to Hurley Road. The main would continue northeast on Hurley Road to KY 490, following KY 490 north to KY 30. The transmission main would run northeast alongside KY 30 to US 421, where it would veer north and connect to the existing JCWA 10-inch transmission main. This equates to approximately 119,500 linear feet, or 22.6 miles, of water transmission line that would have to be laid (Kenvirons, 2000b).

Under this alternative, two pipeline capacities are investigated in this FEIS: a pipeline capable of transporting 1.33 mgd from Wood Creek Lake to the JCWA distribution system and one capable of transporting 2.19 mgd to the JCWA distribution system. Regardless of the pipeline capacity, the same route would be followed.

3.2.1.1.7 Lock 14 Pipeline

The Lock 14 pipeline would be constructed from Lock 14 of the Kentucky River at Heidelberg to the JCWA Treatment Plant at Tyner Lake. From Lock 14 at Heidelberg, the water main would run south alongside KY 399 to Sturgeon Creek Road. The main would then run westward alongside Sturgeon Creek Road, veering south alongside Hale Ridge-Arvel Road. The transmission main would run westward alongside Hale Ridge-Arvel Road to KY 587. The pipeline would run southward along KY 587 until Privett Road. The main would run south alongside Privett Road to KY 1071, continuing in a southwestern direction. From this point, the water transmission main could take one of two routes. One route would be to continue southwest on KY 1071 to US 421, where it would travel southeast to the JCWA Treatment Plant.

Under this option, the entire length of the pipeline would follow alongside existing roadways in the KDOT or County ROW. Another option for the route of this main would be to veer off KY 1071 alongside Peters Road, traveling south-southeast on Peters Road for approximately 3,000 feet, then traveling cross-country to the JCWA Treatment Plant (Kenvirons, 2000c). This equates to approximately 108,000 linear feet, or 20.5 miles, of water transmission line that would have to be laid (Kenvirons, 2000b).

Under this alternative, two pipeline capacities are investigated in this FEIS: a pipeline capable of transporting 1.33 mgd from Lock 14 to the JCWA Treatment Plant and one capable of transporting 2.19 mgd to the JCWA Treatment Plant. Regardless of the pipeline capacity, the same route would be followed.

3.2.1.2 Environmental Consequences

No changes have been made to the list of potential impacts on land use resulting from each of the alternatives for this FEIS. Refer to Section 3.2.1.2, Environmental Consequences, of the DEIS for this list.

As in the DEIS, potential impacts on geology were determined through evaluation of the types of geologic formations present at the proposed project sites, types of activities that would occur under the proposed action, duration of these activities, and the sizes of the affected areas. Impacts on the topography on and around each alternative project site were derived by analyzing the sites for elevation, slope, and topographic features, such as hills or sinkholes. To determine the significance of impacts on topography at each site, consideration was given to the size of the affected areas, the activities under the proposed action anticipated to affect topography, and the duration of activities. Potential impacts on soils were derived by analyzing the types of soils present at each proposed alternative site, depth of these soils, slope of the site, and the permeability and erosive tendencies of the affected soils. The amount of area affected, as well as the duration and severity of potential impacts, were also considered.

Section 3.2.1.2, Environmental Consequences, of the DEIS notes that, during impoundment, downstream flows would be reduced to the 7Q10, the minimum flow required to maintain water quality and aquatic life. This is not necessarily correct. According to the Kentucky Division of Water (KDOW), during impoundment, as well as in operation, the outflow from the dam must equal the inflow into the reservoir during low-flow periods. The 7Q10 would be a rare occurrence; required outflows would be higher than the 7Q10 during most of the low-flow season (summer and fall months).

There are no other changes to this section for the FEIS. Refer to Section 3.2.1.2, Environmental Consequences, of the DEIS for a discussion of potential impacts on geology and soils that are common to all dam and reservoir alternatives, and to all routes of the proposed water transmission pipeline.

3.2.1.2.1 War Fork and Steer Fork

Dam and Reservoir

A visual reconnaissance was performed at the proposed War Fork and Steer Fork dam embankment site near the Turkey Foot Campground and the area immediately downstream of the proposed dam. A report of the site reconnaissance is included in this FEIS as Appendix O. The reconnaissance was performed due to concerns of reported limestone outcrops in the vicinity of the proposed project site (Yost, 2000b). Such outcrops, if extensive, could lead to dam or impoundment leakage, which may, through a karst-related hydraulic connection, affect downstream caves in which endangered bats hibernate. As shown by published geologic data and the results of the site reconnaissance, there does not appear to be any hydraulic connection between the proposed reservoir area and the downstream karst features. Based on the outcrops that are in the vicinity of the proposed dam at the War Fork and Steer Fork site, the dam abutments would be in shale and sandstone. The cut-off trench for the proposed dam would likely be in shale, although the thickness of the shale at that location has not been determined. The geotechnical investigation to be performed at this site prior to the onset of construction should address this issue. A sufficient thickness of shale underlying the proposed dam is desirable to assure hydraulic isolation from the underlying Newman Limestone, which is capable of forming karst drainage systems (Yost, 2000b). Because the shale will be the thinnest directly underneath the stream channel alluvium, at least one rock core boring should be advanced below the stream channel at the location of the proposed dam.

As discussed in Section 3.2.1.1.1 above, although prime farmland soils, as classified by the NRCS, are present on the proposed War Fork and Steer Fork, 3.5 mgd project site, since it is currently public land within the DBNF, it cannot be considered as prime farmland (NRCS, 1989). However, if the War Fork and Steer Fork, 3.5 mgd site is chosen as the final project location in the Record of Decision (ROD), either a land exchange between the USFS and the Jackson County Empowerment Zone (EZ) Community for the land within the project area would need to occur, or a SUP from the USFS for use of this land would need to be obtained. Should a land exchange be conducted, the land within the project area may or may not remain public land. If it does not remain public land, these prime farmland soils would then be concerned prime farmland. Impacts to these soils would be analyzed in the environmental assessment (EA) that would be conducted for the land exchange. Issuance of a SUP for this land would not change the management of the land; the land would remain public land.

There are no other changes to this section for the FEIS. Refer to Section 3.2.1.2.1, War Fork and Steer Fork, of the DEIS for a detailed discussion on the potential impacts on geology and soils resulting from this alternative.

3.2.1.2.2 Sturgeon Creek, 8.5 mgd

There are no changes to this section for the FEIS. Refer to Section 3.2.1.2.2, Sturgeon Creek, 8.5 mgd, of the DEIS for a detailed discussion on the potential impacts on geology and soils resulting from this alternative.

3.2.1.2.3 Sturgeon Creek, 3.5 mgd

There are no changes to this section for the FEIS. Refer to Section 3.2.1.2.3, Sturgeon Creek, 3.5 mgd, of the DEIS for a detailed discussion on the potential impacts on geology and soils resulting from this alternative.

3.2.1.2.4 No Action

There are no changes to this section for the FEIS. Refer to Section 3.2.1.2.4, No Action, of the DEIS for a discussion on the potential impacts on geology and soils resulting from this alternative.

3.2.1.2.5 Summary of Impacts

There are no changes to this section for the FEIS. Refer to Section 3.2.1.2.5, Summary of Impacts, and to Table 3.2.1-2, Summary of Impacts on Geology and Soils, of the DEIS.

3.2.1.2.6 War Fork and Steer Fork, 1.3 mgd

Dam and Reservoir

Construction of a dam at the proposed War Fork and Steer Fork, 1.3 mgd site would require about 11,000 cubic yards of earth to be excavated and stockpiled (Kenvirons, 2000b).

The proposed War Fork and Steer Fork, 1.3 mgd reservoir site contains less than or equal to the estimated 29 acres of prime farmland soils listed for the War Fork and Steer Fork, 3.5 mgd site, within the extent of the maximum flood level, with a 300-foot buffer surrounding the normal pool level. If the War Fork and Steer Fork, 1.3 mgd site is chosen as the final location for the project, these prime farmland soils would be permanently removed from use. However, as discussed in Section 3.2.1.1.4 above, although prime farmland soils, as classified by the NRCS, are present on the proposed War Fork and Steer Fork, 1.3 mgd project site, since it is currently public land within the DBNF, it cannot be considered as prime farmland (NRCS, 1989). If the War Fork and Steer Fork, 1.3 mgd site is chosen as the final project location in the ROD, either a land exchange between the USFS and the Jackson County EZ Community for the land within the project area would have to occur, or a SUP from the USFS for use of this land would need to be obtained. Should a land exchange be conducted, the land within the project area may or may not remain public land. If it does not remain public land, these prime farmland soils would then be concerned prime farmland. Impacts to these soils would be analyzed in the EA that would be conducted for the land exchange. Issuance of a SUP for this land would not change the management of the land; the land would remain public land.

No wetlands are shown within the normal pool elevation of the proposed War Fork and Steer Fork, 1.3 mgd reservoir on National Wetland Inventory (NWI) polygon maps (USFWSM, No date). Therefore, impacts to wetlands at this site would be minimal.

As discussed in Section 3.2.1.2.1, War Fork and Steer Fork, above, a visual reconnaissance was performed at the proposed War Fork and Steer Fork dam embankment site near the Turkey Foot Campground and the area immediately downstream of the proposed dam. A report of the site reconnaissance is included in this FEIS as Appendix O. As shown by published geologic data and the results of the site reconnaissance, there does not appear to be any hydraulic connection between the proposed reservoir area and the downstream karst features. Since the proposed dam at the War Fork and Steer Fork, 1.3 mgd project site would be situated at the same location as the dam for the proposed War Fork and Steer Fork, 3.5 mgd site, the discussion of the underlying geology presented in Section 3.2.1.2.1, War Fork and Steer Fork, above also applies to the War Fork and Steer Fork, 1.3 mgd site.

Raw Water Transmission Main

The raw water transmission main leading from the proposed War Fork and Steer Fork, 1.3 mgd reservoir to the JWCA Treatment Plant would be 12 inches in diameter (Kenvirons, 2000b), requiring a trench of at least 18 inches wide. The trench would be four to five feet deep. A discussion of the potential impacts on geology and soils from the construction of a water transmission pipeline are discussed in Section 3.2.1.2, Environmental Consequences, of the DEIS. Please refer to that section for this information.

3.2.1.2.7 War Fork and Steer Fork, 2.2 mgd

Dam and Reservoir

Construction of a dam at the proposed War Fork and Steer Fork, 2.2 mgd site would require about 14,000 cubic yards of earth to be excavated and stockpiled (Kenvirons, 2000b).

The proposed War Fork and Steer Fork, 2.2 mgd reservoir site contains less than or equal to the estimated 29 acres of prime farmland soils listed for the War Fork and Steer Fork, 3.5 mgd site, within the extent of the maximum flood level, with a 300-foot buffer surrounding the normal pool level. If the War Fork and Steer Fork, 2.2 mgd site is chosen as the final location for the project, these prime farmland soils would be permanently removed from use. However, as discussed in Section 3.2.1.1.5 above, although prime farmland soils, as classified by the NRCS, are present on the proposed War Fork and Steer Fork, 2.2 mgd project site, since it is currently public land within the DBNF, it cannot be considered as prime farmland (NRCS, 1989). If the War Fork and Steer Fork, 2.2 mgd site is chosen as the final project location in the ROD, either a land exchange between the USFS and the Jackson County EZ Community for the land within the project area would have to occur, or a SUP from the USFS for use of this land would need to be obtained. Should a land exchange be conducted, the land within the project area may or may not remain public land. If it does not remain public land, these prime farmland soils would then be concerned prime farmland. Impacts to these soils would be analyzed in the EA that would be conducted for the land exchange. Issuance of a SUP for this land would not change the management of the land; the land would remain public land.

No wetlands are shown within the normal pool elevation of the proposed War Fork and Steer Fork, 2.2 mgd reservoir on NWI polygon maps (USFWSM, No date). Therefore, impacts to wetlands at this site would be minimal.

As discussed in Section 3.2.1.2.1, War Fork and Steer Fork, above, a visual reconnaissance was performed at the proposed War Fork and Steer Fork dam embankment site near the Turkey Foot Campground and the area immediately downstream of the proposed dam. A report of the site reconnaissance is included in this FEIS as Appendix O. As shown by published geologic data and the results of the site reconnaissance, there does not appear to be any hydraulic connection between the proposed reservoir area and the downstream karst features. Since the proposed dam at the War Fork and Steer Fork, 2.2 mgd project site would be situated at the same location as the dam for the proposed War Fork and Steer Fork, 3.5 mgd site, the discussion of the underlying geology presented in Section 3.2.1.2.1, War Fork and Steer Fork, above also applies to the War Fork and Steer Fork, 2.2 mgd site.

Raw Water Transmission Main

The raw water transmission main leading from the proposed War Fork and Steer Fork, 2.2 mgd reservoir to the JWCA Treatment Plant would be 14 inches in diameter (Kenvirons, 2000b), requiring a trench of at least 20 inches wide. The trench would be four to five feet deep. A discussion of the potential impacts on geology and soils from the construction of a water transmission pipeline are discussed in Section 3.2.1.2, Environmental Consequences, of the DEIS. Please refer to that section for this information.

3.2.1.2.8 Wood Creek Lake Pipeline

A water main capable of transporting 1.3 mgd from Wood Creek Lake to the JCWA water distribution system would be 12 inches diameter (Kenvirons 2000b), requiring a trench of at least 18 inches wide. A water main capable of transporting 2.2 mgd from Wood Creek Lake to the JCWA water distribution system would be 14 inches diameter (Kenvirons 2000b), requiring a trench of at least 20 inches wide. The trench for this pipeline, regardless of capacity, would be four to five feet deep. A discussion of the potential impacts on geology and soils from the construction of a water transmission pipeline are discussed in Section 3.2.1.2, Environmental Consequences, of the DEIS. Please refer to that section for this information.

Prime farmland would not be greatly affected during construction of the Wood Creek Lake water transmission pipeline. Any areas considered prime farmland would only be impacted during the construction phase; areas would be returned to their previous use after construction. Given the length of this pipeline, 119,000 linear feet, and assuming the estimated maximum soil disturbance at any location is 10 square feet, as was used in the DEIS, no more than 27.4 acres would be disturbed during construction of the Wood Creek Lake pipeline. The worst-case scenario would assume that the entire route of this transmission main is classified as prime. Under this scenario, this extent would still be small according to the criteria outlined in Appendix C of this EIS. Given the unlikelihood of this worst-case scenario, impacts to prime farmland due to the construction of this pipeline would be rated as insignificant.

3.2.1.2.9 Lock 14 Pipeline

A water main capable of transporting 1.3 mgd from Lock 14 of the Kentucky River to the JCWA Treatment Plant would be 12 inches diameter (Kenvirons 2000b), requiring a trench of at least 18 inches wide. A water main capable of transporting 2.2 mgd from Lock 14 to the JCWA Treatment Plant would be 14 inches diameter (Kenvirons 2000b), requiring a trench of at least 20 inches wide. The trench for this pipeline, regardless of capacity, would be four to five feet deep. A discussion of the potential impacts on geology and soils from the construction of a water transmission pipeline are discussed in Section 3.2.1.2, Environmental Consequences, of the DEIS. Please refer to that section for this information.

Prime farmland would not be greatly affected during construction of the water transmission pipeline from Lock 14. Any areas considered prime farmland would only be impacted during the construction phase; areas would be returned to their previous use after construction. Given the length of this pipeline, 108,000 linear feet, and assuming the estimated maximum soil disturbance at any location is 10 square feet, as was used in the DEIS, no more than 24.8 acres would be disturbed during construction of the Lock 14 pipeline. The worst-case scenario would assume that the entire route of this transmission main is classified as Prime. Under this scenario, this extent would still be small according to the criteria outlined in Appendix C of this EIS. Given the unlikelihood of this worst-case scenario, impacts to Prime Farmland due to the construction of this pipeline would be rated as insignificant.

3.2.1.2.10 Summary of Impacts

The following table lists the potential impacts on soils and geology resulting from the additional alternatives investigated in this FEIS.

Table 3.2.1-4. Summary of Impacts on Geology and Soils From Reassessed Alternatives

Alternative	Impacts	Rating of Impacts
War Fork and Steer Fork, 1.3 mgd	• Increased surface water runoff and soil erosion from site preparation and construction activities; • Long-term soil erosion at the reservoir; • Soil contamination from potential POL/ chemical or sanitary waste spills; • Fracture bedrock during potential blasting or from the weight of the dam; • Permanent loss of prime farmland; and • Degradation of wetlands.	• Moderately Significant • Moderately Significant • Insignificant • Insignificant • Moderately Significant • Insignificant
War Fork and Steer Fork, 2.2 mgd	• Increased surface water runoff and soil erosion from site preparation and construction activities; • Long-term soil erosion at the reservoir; • Soil contamination from potential POL/ chemical or sanitary waste spills;	• Moderately Significant • Moderately Significant • Insignificant

	• Fracture bedrock during potential blasting or from the weight of the dam; • Permanent loss of prime farmland; and • Degradation of wetlands.	• Insignificant • Moderately Significant • Insignificant
Wood Creek Lake Pipeline	• Increased surface water runoff and soil erosion from construction activities and during stream crossings; • Soil contamination from potential POL/ chemical or sanitary waste spills; and • Permanent loss of prime farmland.	• Moderately Significant • Insignificant • Insignificant
Lock 14 Pipeline	• Increased surface water runoff and soil erosion from construction activities, and during stream crossings; • Soil contamination from potential POL/ chemical or sanitary waste spills; and • Permanent loss of prime farmland.	• Moderately Significant • Insignificant • Insignificant

3.2.1.3 Mitigation

At the War Fork and Steer Fork site in particular, it is recommended that one or more rock core borings be advanced below the stream channel at the location of the proposed dam, as the underlying shale will be thinnest there. There are no other changes to this section for the FEIS. Refer to Section 3.2.1.3, Mitigation, of the DEIS for a discussion of measures that could minimize potential adverse impacts on geology and soils resulting from the project.

3.2.2 SURFACE AND GROUNDWATER RESOURCES/QUANTITY AND QUALITY

3.2.2.1 Affected Environment

3.2.2.1.1 War Fork and Steer Fork

There are no changes or additions to this section for the FEIS. Refer to Section 3.2.2.1.1, War Fork and Steer Fork, of the DEIS for a description of the affected environment for this alternative.

3.2.2.1.2 Sturgeon Creek, 8.5 mgd

There are no changes or additions to this section for the FEIS. Refer to Section 3.2.2.1.2, Sturgeon Creek, 8.5 mgd, of the DEIS for a description of the affected environment for this alternative.

3.2.2.1.3 Sturgeon Creek, 3.5 mgd

There are no changes or additions to this section for the FEIS. Refer to Section 3.2.2.1.3, Sturgeon Creek, 3.5 mgd, of the DEIS for a description of the affected environment for this alternative.

3.2.2.1.4 War Fork and Steer Fork, 1.3 mgd

Dam and Reservoir

The boundaries of the War Fork and Steer Fork, 1.3 mgd project site lie completely within those of the War Fork and Steer Fork, 3.5 mgd project site that was described in the DEIS. Therefore, the affected environment, as it relates to surface and groundwater resources, is the same for these two alternatives. Refer to Section 3.2.2.1.1, War Fork and Steer Fork, of the DEIS for this information.

Raw Water Transmission Main

The approximately 8.9-mile proposed route for the raw water transmission main leading from the proposed War Fork and Steer Fork, 1.3 mgd reservoir to the Jackson County Water Association (JCWA) Treatment Plant would run mostly alongside existing Kentucky Department of Transportation (KDOT) or County rights-of-way (ROW) for all but about one mile of the route. ROW would need to be obtained in the form of a Special Use Permit for National Forest jurisdiction roads F.S. 3109 Turkey Foot Road. In addition to one or two crossings of Hughes Fork, a tributary of War Fork, there are a number of minor and intermittent creeks that would have to be crossed en route. Preliminary engineering analysis estimates a total of 60 linear feet

of creek crossings (Kenvirons, 2000b). Much of the proposed route would follow KY 587, which runs along the high divides between several watersheds, thereby avoiding most direct contact with watercourses.

3.2.2.1.5 War Fork and Steer Fork, 2.2 mgd

Dam and Reservoir

The boundaries of the War Fork and Steer Fork, 2.2 mgd project site lie completely within those of the War Fork and Steer Fork, 3.5 mgd project site that was described in the DEIS. Therefore, the affected environment, as it relates to surface and groundwater resources, is the same for these two alternatives. Refer to Section 3.2.2.1.1, War Fork and Steer Fork, of the DEIS for this information.

Raw Water Transmission Main

The raw water transmission main leading from the proposed War Fork and Steer Fork, 2.2 mgd reservoir to the JCWA Treatment Plant would follow the same route as that proposed for the transmission main leading from the proposed War Fork and Steer Fork, 1.3 mgd reservoir discussed in Section 3.2.2.1.4 above. Please refer to that section for this information.

3.2.2.1.6 Wood Creek Lake Pipeline

The Wood Creek Lake water transmission pipeline would be constructed from the existing Wood Creek Water District 20-inch transmission main on Filter Plant Road, just east of Wood Creek Lake. The entire length of the pipeline would follow alongside existing roadways in the KDOT or County ROW. The transmission pipeline would continue northeast on Filter Plant Road, turning southeast alongside US 25. The pipeline would follow alongside US 25 to Dean Hundley Road, where it would run northeast to Hurley Road. The main would continue northeast on Hurley Road to KY 490, following KY 490 north to KY 30. The transmission main would run northeast alongside KY 30 to US 421, where it would veer north and connect to the existing JCWA 10-inch transmission main.

Under this alternative, two pipeline capacities are investigated in this FEIS: a pipeline capable of transporting 1.33 mgd from Wood Creek Lake to the JCWA distribution system and one capable of transporting 2.19 mgd to the JCWA distribution system. Regardless of the capacity of the pipeline constructed under this alternative, construction would require crossing 1,060 linear feet of streams (Kenvirons, 2000b).

No swimming or other primary contact recreation is permitted on Wood Creek Lake. In addition, no houseboats or boats with toilet facilities are permitted on the lake. The Wood Creek Water District uses techniques such as flocculation and chlorination to treat raw water withdrawn from Wood Creek Lake for the purposes of water supply, and has never had any problems meeting national and State drinking water standards. The only reported water quality problem at Wood Creek Lake was due to algal blooms (Napier, 2000).

3.2.2.1.7 Lock 14 Pipeline

From Lock 14 at Heidelberg, the Lock 14 raw water transmission main would run south alongside KY 399 to Sturgeon Creek Road. The main would then run westward alongside Sturgeon Creek Road, veering south alongside Hale Ridge-Arvel Road. The transmission main would run westward alongside Hale Ridge-Arvel Road to KY 587. The pipeline would run southward along KY 587 until Privett Road. The main would run south alongside Privett Road to KY 1071, continuing in a southwestern direction. From this point, the water transmission main could take one of two routes. One route would be to continue southwest on KY 1071 to US 421, where it would travel southeast to the JCWA Treatment Plant. Another option for the route of this main would be to veer off KY 1071 alongside Peters Road, traveling south-southeast on Peters Road for approximately 3,000 feet, then traveling cross-country to the JCWA Treatment Plant (Kenvirons, 2000c).

Under this alternative, two pipeline capacities are investigated in this FEIS: a pipeline capable of transporting 1.33 mgd from Lock 14 of the Kentucky River to the JCWA Treatment Plant and one capable of transporting 2.19 mgd to the JCWA Treatment Plant. Regardless of the capacity of the pipeline constructed under this alternative, construction of this water main would require crossing 150 linear feet of streams (Kenvirons, 2000b).

3.2.2.2 Environmental Consequences

One addition has been made to the list of potential impacts on surface and groundwater resources resulting from the proposed project, specifically from the dam and reservoir alternatives. This addition is:

- Permanent conversion of waters of the United States from a flowing (lotic) condition to a standing (lentic) condition.

Please refer to Section 3.2.2.2, Environmental Consequences, of the DEIS for the remainder of the list of potential impacts on surface and groundwater resources which may result from the proposed action.

As in the DEIS, potential impacts on surface and groundwater resources, both flows (quantity) and water quality, were derived from evaluating features of the proposed action that could affect these parameters, as well as evaluating the hydrologic characteristics of the proposed project sites. The associated watersheds and downstream watercourses were also considered.

Dam and Reservoir

As noted in the DEIS, the volume and seasonal pattern of downstream flows should not be appreciably altered during the 1.5-year construction phase of the proposed dam and reservoir. Assuming normal weather patterns, high flows would occur in the winter and spring months and low flows in summer and autumn, as is the case at present. However, once impoundment of the

reservoir begins, long-term changes to water quality and quantity both downstream and in the reservoir would occur.

Section 3.2.2.2, Environmental Consequences, of the DEIS notes that, during impoundment, downstream flows would be reduced to the minimum average flow that occurs for seven consecutive days with a recurrence interval of ten years (7Q10). This is not necessarily correct. According to the Kentucky Division of Water (KDOW), during impoundment, as well as in operation, the outflow from the dam must equal the inflow into the reservoir during low-flow periods. The flow would not be reduced to the 7Q10 unless the natural flow is equal to the 7Q10. The 7Q10 would be a rare occurrence; required outflows would be higher than the 7Q10 during most of the low-flow season (summer and fall months).

Table 3.2.2-2, Reductions in Flows Downstream of the Proposed Project Sites, in Section 3.2.2.2, Environmental Consequences, of the DEIS provides estimates of long-term downstream reductions in flow at the War Fork and Steer Fork and the Sturgeon Creek, 8.5 mgd and 3.5 mgd project sites, if dams and reservoirs of the given specifications were constructed at the sites. Since the outflow from the dam must equal the inflow into the reservoir during low-flow periods, both during impoundment and over the lifetime of the project, the values presented in Table 3.2.2-2 for low flow conditions are not necessarily correct. It should be emphasized that the values in the table assume that the water withdrawn is the maximum rate of withdrawal for each facility, a situation that would not be reached for decades. These values are subject to change depending on the conditions of the Water Withdrawal Permit issued by the KDOW. In issuing the Water Withdrawal Permit, KDOW would examine downstream uses, impacts, and the flows needed to protect the environment in order to develop the required release rates.

To further clarify the issue of reductions in downstream discharge, **Table 3.2.2-4** was created for this FEIS for all of the dam and reservoir alternatives investigated in both the DEIS and this FEIS. The figures presented in **Table 3.2.2-4** are estimates of present and predicted future annual discharges, not average daily flows. Under natural conditions, stream flows fluctuate greatly from day to day and from season to season. These fluctuations are dependent upon short-term weather conditions, such as storm events, and longer-term climatic patterns. The percentage reductions in discharge shown in **Table 3.2.2-4** are on an annual basis, not on a daily basis, and assume maximum withdrawal at each facility. The figures in the table do not imply the same percentage reduction in downstream discharge during low-flow months. For example, the 36 percent reduction in annual discharge noted for the War Fork and Steer Fork, 1.3 mgd facility during worst drought conditions means that approximately 840 million gallons of water would flow downstream of the proposed dam site, rather than the 1,310 million gallons that currently flow at this site during a drought year. During high-flow winter and early spring months, the percent reduction in annual discharge for the War Fork and Steer Fork, 1.3 mgd facility would be greater than 36 percent noted in the table. During low-flow summer and early fall months, the percentage reduction would be less than 36 percent, even without KDOW flow-through conditions, which mandate that outflow must be equal to inflow during low-flow months.

Table 3.2.2-4. Reductions in Annual Discharge Downstream of the Proposed Impoundment Sites (Billions of Gallons Per Year (BGY))

Flow Rates and Percent Reductions Based on Maximum Withdrawal	Proposed Facility				
	War Fork, 3.5 mgd	War Fork, 2.2 mgd	War Fork, 1.3 mgd	Sturgeon Creek, 8.5 mgd	Sturgeon Creek, 3.5 mgd
Estimated existing long-term average discharge at dam site (BGY)	3.94	3.94	3.94	7.70	5.66
Predicted annual average discharge downstream of dam (BGY) (% reduction from existing long-term average)	2.66 (32 %)	3.14 (20 %)	3.47 (12 %)	4.60 (40 %)	4.38 (23 %)
Estimated existing annual discharge at dam site during average drought condition years (BGY)	2.08	2.08	2.08	4.05	2.99
Predicted annual discharge downstream of dam during average drought condition years (BGY) (% reduction from existing average drought annual discharge)	0.80 (62 %)	1.28 (38 %)	1.61 (23 %)	0.95 (77 %)	1.72 (42 %)
Estimated existing annual discharge at dam site during worst drought condition years (BGY)	1.31	1.31	1.31	2.56	1.90
Predicted annual discharge downstream of dam during worst drought condition years (BGY) (% reduction from existing worst drought annual discharge)	0.04 (97 %)	0.51 (61 %)	0.84 (36 %)	0.00 (100 %)	0.62 (67 %)

As mentioned in the DEIS, a Section 404 (Clean Water Act (CWA)) permit would need to be obtained from the U.S. Army Corps of Engineers (USACE) in order for the any of the proposed dam and reservoir alternatives to proceed, due to the presence of jurisdictional waters in which fill material would be discharged during construction of the dam. Section 404 of the CWA establishes a program to regulate the discharge of dredged and fill material into the waters of the United States, including wetlands (USEPA, 1999c). Regulations implementing the program state that "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic environment, so long as the alternative does not have other significant adverse environmental consequences" (40 CFR 230.10 (a)). A "discharge of dredged or fill material" essentially includes all land-disturbing activities conducted with mechanized equipment.

For actions in which the USACE is the permitting agency, the analysis of alternatives must meet the requirements for evaluation of alternatives set forth under the Section 404 (b)(1) Guidelines.

According to USACE review of this EIS (refer to the USACE comment letter presented in Appendix V (V-2) of this FEIS), in order to satisfy the requirements of the Section 404 (b)(1) Guidelines for the evaluation of alternatives, this EIS would need to be supplemented with additional information during the 404 permitting process. The comments provided by the USACE on this EIS note the areas where additional information pursuant to the Guidelines may be necessary. Refer to Appendix V (V-2) of this FEIS for this information.

The Guidelines developed to implement the CWA regulations further state that "discharges of dredged or fill material into waters of the United States, including wetlands, should not occur unless it can be demonstrated that such discharges, either individually or cumulatively, will not result in unacceptable adverse effects on the aquatic ecosystem" (MOA, 1989). Applicants for a 404 permit must prove to the USACE and the U.S. Environmental Protection Agency (EPA) that they have: taken steps to avoid wetland impacts, where practicable; minimized potential impacts to wetlands; and provided compensation for any remaining, unavoidable impacts by restoring or creating wetlands.

In accordance with Section 404 of the CWA, compensatory mitigation would be needed for discharge of fill into the waters of the United States. In other words, the lost values of a free-flowing stream would have to be replaced elsewhere, preferably as close as possible to the chosen final project site. Compensatory mitigation could be accomplished by stream restoration or enhancement. There are many streams in Eastern Kentucky that have been degraded by such things as strip mining, acid mine drainage, logging, and agriculture, on which restoration work could be done (Sparks, 2000).

Alternatively, in-lieu-of payments could be paid by the applicant to the USACE, a third party, or a restoration fund. Elsewhere in the USACE, Louisville District, in-lieu-of payments equate to approximately $100 per linear foot of impacted water of the United States. Such costs would need to be included in the total project costs for each proposed dam and reservoir alternative.

A jurisdictional wetlands delineation and waters determination has been completed for this FEIS for the proposed War Fork and Steer Fork and Sturgeon Creek dam and reservoir sites to determine the acreage of wetlands that would be replaced with aquatic habitat, should a dam and reservoir alternative be chosen as the action to be taken, and the amount of jurisdictional waters affected. According to the USACE and EPA, the regulatory definition of Section 404 jurisdictional wetlands includes "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (Libby et al., 2001).

An on-site wetland delineation was conducted at the proposed dam and reservoir sites as per the three-parameter method described in the *Corps of Engineers Wetlands Delineation Manual*, which is the legally-accepted system for identifying a wetland. According to this method, positive evidence of three criteria must be found on an area before that area can be termed a wetland. These three criteria are hydrophytic vegetation, hydric soils, and wetland hydrology (Libby et al., 2001). In addition to the wetland delineation, a field survey of all waters of the United States was conducted at the proposed dam and reservoir sites. The complete report of the

results of the jurisdictional wetlands delineation and waters determination is included as Appendix U of this FEIS. These results are summarized for each proposed dam and reservoir alternative in Sections 3.2.2.2.1 through 3.2.2.2.3, 3.2.2.2.6, and 3.2.2.2.7 below. It should be noted that the results of this jurisdictional waters determination are not official until concurrence is received by the USACE, Louisville Regulatory District.

Given the magnitude of impacts to waters of the United States, which are summarized site-specifically below, an Individual Permit would be required to complete the project at any of the proposed reservoir sites. Once a complete permit application package, including a mitigation plan, is submitted to the USACE, a Public Notice would be issued by the USACE for comments. Processing of an Individual Permit typically takes between 90 and 120 days; however, this process could take longer depending on the amount of comments received (Libby et al., 2001).

Recreational use of the reservoir would affect the raw water quality of the reservoir to some degree. Swimming could cause localized turbidity in designated swimming areas from stirring up sediments. Swimming could also generate bacterial contamination, such as fecal coliform pollution. The use of boats with motors, if motors are permitted on the reservoir, could discharge small amounts of oil and gas residues into the lake. Boats with toilets that discharge into the water would be prohibited on the reservoir, so as to eliminate this source of fecal contamination. Overall, neither primary nor secondary contact recreation would be expected to pose serious water quality problems for end users of potable water because water treatment methods, including such processes as chlorination and powdered activated carbon, can successfully remove contaminants to acceptable levels (Lange, 2000b; Napier, 2000; Powell, 1999a; Roney, 1999; Skaggs, 1999). These water treatment processes are further described in Sections 3.2.2.2, Environmental Consequences, Surface and Groundwater Resources, and 3.2.10.1, Waste Management, Affected Environment, of the DEIS.

Raw Water Transmission Main

There are no changes to this section for the FEIS. Refer to Section 3.2.2.2, Environmental Consequences, Raw Water Transmission Main, of the DEIS for a discussion of potential impacts on surface and groundwater resources resulting from this action common to all alternatives. There are no site-specific impacts related to this activity.

3.2.2.2.1 War Fork and Steer Fork

A jurisdictional wetlands delineation and waters determination was conducted at the proposed War Fork and Steer Fork, 3.5 mgd reservoir site, and is included as Appendix U of this FEIS. As a result of this delineation, no jurisdictional wetlands were found to be present on the proposed War Fork and Steer Fork, 3.5 mgd project site (Libby et al., 2001). Therefore, no wetlands would be impacted by the proposed action at this site. In addition, no ponds were found within or adjacent to the War Fork and Steer Fork, 3.5 mgd site (Libby et al., 2001).

At the maximum flood elevation (1,000 feet above MSL) of the proposed War Fork and Steer Fork, 3.5 mgd reservoir, approximately 12,600 linear feet of War Fork and 4,800 linear feet of Steer Fork would be inundated. In addition, approximately 800 linear feet of Guys Branch and

2,200 linear feet of three separate unnamed tributaries would be inundated by the project at this site. The total linear feet of streams that would be affected by the project at the War Fork and Steer Fork, 3.5 mgd site is about 20,400 (or about 11.57 acres) at the maximum flood level of the proposed reservoir (Libby et al., 2001). The total length of streams affected at the normal pool elevation of the proposed reservoir at this site, 980 feet above MSL, would be somewhat smaller.

There are no other changes to this section for the FEIS. Refer to Section 3.2.2.2.1, War Fork and Steer Fork, of the DEIS for a detailed discussion of the potential impacts on surface and groundwater quantity and quality which may result from this alternative.

3.2.2.2.2 Sturgeon Creek, 8.5 mgd

A jurisdictional wetlands delineation and waters determination was conducted at the proposed Sturgeon Creek, 8.5 mgd dam and reservoir site, and is included as Appendix U of this FEIS. The project area boundary that was used for the wetlands delineation and waters determination at the proposed Sturgeon Creek, 8.5 mgd site was the potential maximum flood level elevation of the proposed reservoir at that site, or 1,010 feet above MSL.

Using the USACE-approved three-parameter method discussed in Section 3.2.2.2 above, five wetland areas were found on and immediately adjacent to the proposed Sturgeon Creek, 8.5 mgd project site, totaling 2.71 acres (Libby et al., 2001). The acreages of these wetlands are presented in **Table 3.2.2-5**. Four of these wetlands, Wetlands B, C, D, and E in **Table 3.2.2-5**, are located within the boundary of the proposed Sturgeon Creek, 8.5 mgd reservoir, and would be eliminated if the project were to proceed at this site. The remaining wetland, Wetland A in the table, is located just outside the project boundary next to Blackwater Creek, and may not be impacted by implementation of the project at this site (Libby et al., 2001). Descriptions and classifications of these wetlands is provided in Appendix U of this FEIS.

Table 3.2.2-5. Acreages of Wetlands Located Within or Adjacent to the Proposed Sturgeon Creek, 8.5 mgd and 3.5 mgd Dam and Reservoir Sites

Wetland	Acreage	Sturgeon Creek, 8.5 mgd	Sturgeon Creek, 3.5 mgd
A	0.44 acre	Adjacent	N/A
B	0.19 acre	Within	N/A
C	0.34 acre	Within	Within
D	1.72 acre	Within	Within
E	0.02 acre	Within	Within
	Total Acreage	2.71 acres	2.08 acres

Source: Libby et al., 2001

The survey found 21 man-made ponds within or adjacent to the proposed Sturgeon Creek, 8.5 mgd reservoir site, totaling 3.66 acres (Libby et al., 2001). The individual acreages of these ponds are presented in **Table 3.2.2-6**. Five of the ponds, totaling 0.34 acres, were determined to meet the criteria of wetland. However, these ponds would not be considered "jurisdictional" wetland in this USACE regulatory district unless they were formed in hydric soils or in a stream channel, which none of them were. Of the 21 ponds, 9 ponds, totaling 0.98 acres, are located just outside of the project boundary and may not be affected by implementation of the project at this

site. In addition, some of these ponds may be located within the potential maximum flood level of the proposed Sturgeon Creek, 8.5 reservoir only, and may not be impacted unless this maximum flood level is reached. All of these ponds were created for farming, sediment control, or recreational purposes (Libby et al., 2001). **Table 3.2.2-6** depicts which ponds are located within the proposed Sturgeon Creek, 8.5 project area, and which are located immediately adjacent to the project boundary. Classifications of these ponds, as well as location maps, are provided in Appendix U of this FEIS.

Table 3.2.2-6. Acreages of Ponds Located Within or Adjacent to the Proposed Sturgeon Creek, 8.5 mgd and 3.5 mgd Dam and Reservoir Sites

Pond	Acreage	Sturgeon Creek, 8.5 mgd	Sturgeon Creek, 3.5 mgd
1	0.05 acre	Adjacent	N/A
2	0.08 acre	Adjacent	N/A
3	0.05 acre	Adjacent	N/A
4	0.05 acre	Adjacent	N/A
5	0.12 acre	Within	N/A
6*	0.12 acre	Within	N/A
7	0.29 acre	Adjacent	N/A
8*	0.07 acre	Adjacent	N/A
9	0.29 acre	Adjacent	N/A
10	0.12 acre	Within	N/A
11	0.12 acre	Within	Within
12*	0.05 acre	Adjacent	Adjacent
13	0.29 acre	Within	Within
14	0.05 acre	Within	Within
15	0.07 acre	Within	Within
16*	0.05 acre	Adjacent	Adjacent
17	0.05 acre	Within	Within
18	0.07 acre	Within	Within
19	0.12 acre	Within	Within
20*	0.05 acre	Within	Within
21	1.50 acre	Within	Within
Total Acreage Within		2.68 acres	2.32 acres
Total Acreage Adjacent		0.98 acre	0.10 acre
Total Acreage		3.66 acres	2.42 acres

* These ponds meet the criteria of jurisdictional wetland.
Source: Libby et al., 2001

At the maximum flood elevation (1,010 feet above MSL) of the proposed Sturgeon Creek, 8.5 mgd reservoir, approximately 27,000 linear feet of Sturgeon Creek would be inundated. In addition, approximately 10,400 linear feet of Blackwater Creek, 5,800 linear feet of Wilfreds Fork, and 15,200 linear feet of several unnamed tributaries of Sturgeon Creek, Blackwater Creek, and Wilfreds Fork would also be inundated by the project at this site. The total linear feet of streams that would be affected by the project at the Sturgeon Creek, 8.5 mgd site is about 58,400 (or about 31.91 acres) at the maximum flood level of the proposed reservoir (Libby et al.,

2001). The total length of streams affected at the normal pool elevation of the proposed reservoir at this site, 990 feet above MSL, would be somewhat smaller.

There are no other changes to this section for the FEIS. Refer to Section 3.2.2.2.2, Sturgeon Creek, 8.5 mgd, of the DEIS for a detailed discussion of the potential impacts on surface and groundwater quantity and quality which may result from this alternative.

3.2.2.2.3 Sturgeon Creek, 3.5 mgd

A jurisdictional wetlands delineation and waters determination was conducted at the proposed Sturgeon Creek, 3.5 mgd dam and reservoir site, and is included as Appendix U of this FEIS. The project area boundary that was used for the wetlands delineation and waters determination at the proposed Sturgeon Creek, 3.5 mgd site was the potential maximum flood level elevation of the proposed reservoir at that site, or 1,000 feet above MSL.

During the survey, three wetland areas were found on the proposed Sturgeon Creek, 3.5 mgd project site, totaling 2.08 acres (Libby et al., 2001). The acreages of these wetlands are presented in **Table 3.2.2-5** above. All of these wetlands, Wetlands C, D, and E in **Table 3.2.2-5**, are located within the boundary of the proposed Sturgeon Creek, 3.5 mgd reservoir, and would be eliminated if the project were to proceed at this site (Libby et al., 2001). Descriptions and classifications of these wetlands is provided in Appendix U of this FEIS.

The survey found 10 man-made ponds within or adjacent to the proposed Sturgeon Creek, 3.5 mgd reservoir site, totaling 2.42 acres (Libby et al., 2001). The individual acreages of these ponds are presented in **Table 3.2.2-6** above. Three of the ponds, totaling 0.15 acres, were determined to meet the criteria of wetland. However, these ponds would not be considered "jurisdictional" wetland in this USACE regulatory district unless they were formed in hydric soils or in a stream channel, which none of them were. Of the 10 ponds, 2 ponds, totaling 0.10 acres, are located just outside of the project boundary and may not be affected by implementation of the project at this site. In addition, some of these ponds may be located within the potential maximum flood level of the proposed Sturgeon Creek, 3.5 reservoir only, and may not be impacted unless this maximum flood level is reached. All of these ponds were created for farming, sediment control, or recreational purposes (Libby et al., 2001). **Table 3.2.2-6** depicts which ponds are located within the proposed Sturgeon Creek, 3.5 project area, and which are located immediately adjacent to the project boundary. Classifications of these ponds, as well as location maps, are provided in Appendix U of this FEIS.

Although the exact linear feet of streams that would be inundated by the construction of a dam and reservoir at the proposed Sturgeon Creek, 3.5 mgd site was not estimated as part of the survey, the length of streams affected would be less than that estimated for the Sturgeon Creek, 8.5 mgd site discussed in Section 3.2.2.2.2 above. The reservoir at the proposed Sturgeon Creek, 3.5 mgd site would have a normal pool elevation of about 980 feet above MSL and a potential maximum flood elevation of about 1,000 feet above MSL. At the maximum flood elevation, the proposed Sturgeon Creek, 3.5 mgd reservoir, would inundate portions of Sturgeon Creek, Wilfreds Fork, and several unnamed tributaries of Sturgeon Creek and Wilfreds Fork.

There are no other changes to this section for the FEIS. Refer to Section 3.2.2.2.3, Sturgeon Creek, 3.5 mgd, of the DEIS for a detailed discussion of the potential impacts on surface and groundwater quantity and quality which may result from this alternative.

3.2.2.2.4 No Action

There are no changes to this section for the FEIS. Refer to Section 3.2.2.2.4, No Action, of the DEIS for a discussion of the potential impacts on surface and groundwater resources which may result from this alternative.

3.2.2.2.5 Summary of Impacts

Based on public and agency comments received on the DEIS, and subsequent review of the impacts analysis conducted for the three dam and reservoir alternatives investigated in the DEIS, a couple changes or additions have been made to the list and ratings of impacts presented for these alternatives. One additional impact resulting from all three dam and reservoir alternatives examined in the DEIS is the permanent conversion of waters of the United States from a flowing condition to a standing condition. This impact would be rated as moderately significant according to the criteria presented in Appendix C of this EIS for all three dam and reservoir sites investigated in the DEIS. In the DEIS, impacts associated with a long term reduction in flows into the Wild and Scenic Study River segment downstream of the proposed War Fork and Steer Fork, 3.5 mgd reservoir, as a result of reservoir water withdrawals, was given an insignificant rating. This rating has been changed to moderately significant for this FEIS. There are no other changes to this section for the FEIS. Refer to Section 3.2.1.2.5, Summary of Impacts, and to Table 3.2.2-3, Summary of Impacts on Surface and Groundwater Resources, of the DEIS.

3.2.2.2.6 War Fork and Steer Fork, 1.3 mgd

Approximately 65 acres of surface water, at normal pool, would be created be created behind the proposed War Fork and Steer Fork, 1.3 mgd dam. As a result of seasonal variations in precipitation, inflow, and outflow, the proposed reservoir would experience fluctuations in the water surface level, down to 19 feet below the normal pool (Kenvirons, 2000b).

A jurisdictional wetlands delineation and waters determination was conducted at the proposed War Fork and Steer Fork, 1.3 mgd reservoir site, and is included as Appendix U of this FEIS. As a result of this delineation, no jurisdictional wetlands were found to be present on the proposed War Fork and Steer Fork, 1.3 mgd project site (Libby et al., 2001). Therefore, no wetlands would be impacted by the proposed action at this site. In addition, no ponds were found within or adjacent to the War Fork and Steer Fork, 1.3 mgd site (Libby et al., 2001).

Although the exact linear feet of streams that would be inundated by the construction of a dam and reservoir at the proposed War Fork and Steer Fork, 1.3 mgd site was not estimated as part of the survey, the length of streams affected would be much less than that estimated for the War Fork and Steer Fork, 3.5 mgd site discussed in Section 3.2.2.2.1 above. The reservoir at the proposed War Fork and Steer Fork, 1.3 mgd site would have a normal pool elevation of about 946 feet above MSL and a potential maximum flood elevation of about 966 feet above MSL. At

both the normal pool and maximum flood levels of the proposed reservoir at this site, there would be no inundation of Guys Branch. At the normal pool level of the proposed reservoir at this site, only a small portion of one unnamed tributary would be affected by the project, while at the potential maximum flood level of the proposed reservoir, small portions of two unnamed tributaries would be inundated.

Sediment accumulation in the proposed reservoir at the proposed War Fork and Steer Fork, 1.3 mgd site was estimated. After 50 years, 396 acre-feet of sediments are expected to have accumulated in the reservoir, or about 23 percent of the total volume. This means that 7.92 acre-feet of sediments in transport would be intercepted and impounded annually. An acre-foot is a unit of volume equal to one acre (43,560 square feet) covered with water or sediments one foot deep, or about 326,000 gallons.

Average annual discharge at War Fork is approximately 12,085 acre-feet, equivalent to an annual average flow of about 10.8 mgd. Assuming that a reservoir at the War Fork and Steer Fork, 1.3 mgd site ultimately withdraws about 1.3 mgd from that stream, average annual discharge immediately downstream would be reduced by about 12 percent. During average drought years and worst drought years, annual discharge immediately downstream of the dam would be reduced by about 23 percent and 36 percent, respectively. These percentage reductions in flow hold for only about one-half mile because of water added by tributaries. It must also be noted that these figures do not imply the same percentage reduction in downstream discharge during low-flow months.

Water withdrawals from a reservoir at the proposed War Fork and Steer Fork, 1.3 mgd site would not adversely affect downstream permitted water withdrawals, since there are none, neither existing nor pending, on either the downstream portion of War Fork or Station Camp Creek (to which it is tributary) all the way to the Kentucky River (Caldwell, 1999a).

Long-term flows to the karst region downstream of the proposed reservoir, where War Fork disappears underground for about a mile, would be reduced. This could slow the long-term rate at which limestone is dissolved and caves formed in that area (Walker, 1999).

Other potential impacts on surface and groundwater resources resulting from a dam and reservoir at the proposed War Fork and Steer Fork, 1.3 mgd site would be the same as those discussed in Section 3.2.2.2.1, War Fork and Steer Fork, of the DEIS. This section contains a discussion of potential impacts to the Wild and Scenic Study River segment, located about 0.5 miles downstream of the proposed War Fork and Steer Fork, 1.3 mgd dam site.

3.2.2.2.7 War Fork and Steer Fork, 2.2 mgd

Approximately 88 acres of surface water, at normal pool, would be created be created behind the proposed War Fork and Steer Fork, 2.2 mgd dam. As a result of seasonal variations in precipitation, inflow, and outflow, the proposed reservoir would experience fluctuations in the water surface level, down to 26 feet below the normal pool (Kenvirons, 2000b).

A jurisdictional wetlands delineation and waters determination was conducted at the proposed War Fork and Steer Fork, 2.2 mgd reservoir site, and is included as Appendix U of this FEIS. As a result of this delineation, no jurisdictional wetlands were found to be present on the proposed War Fork and Steer Fork, 2.2 mgd project site (Libby et al., 2001). Therefore, no wetlands would be impacted by the proposed action at this site. In addition, no ponds were found within or adjacent to the War Fork and Steer Fork, 2.2 mgd site (Libby et al., 2001).

Although the exact linear feet of streams that would be inundated by the construction of a dam and reservoir at the proposed War Fork and Steer Fork, 2.2 mgd site was not estimated as part of the survey, the length of streams affected would be less than that estimated for the War Fork and Steer Fork, 3.5 mgd site discussed in Section 3.2.2.2.1 above, but slightly greater than that for the proposed War Fork and Steer Fork, 1.3 mgd reservoir. The reservoir at the proposed War Fork and Steer Fork, 2.2 mgd site would have a normal pool elevation of about 960 feet above MSL and a potential maximum flood elevation of about 980 feet above MSL. At the normal pool level of the proposed reservoir at this site, there would be no inundation of Guys Branch, and only small portions of two unnamed tributaries would be affected. However, a small portion of Guys Branch would be inundated at the potential maximum flood level of the proposed reservoir at this site, along with portions of three unnamed tributaries.

Sediment accumulation in the proposed reservoir at the proposed War Fork and Steer Fork, 2.2 mgd site was estimated. After 50 years, 396 acre-feet of sediments are expected to have accumulated in the reservoir, or about 14 percent of the total volume. This means that 7.92 acre-feet of sediments in transport would be intercepted and impounded annually.

Average annual discharge at War Fork is approximately 12,085 acre-feet, equivalent to an annual average flow of about 10.8 mgd. Assuming that a reservoir at the War Fork and Steer Fork, 2.2 mgd site ultimately withdraws about 2.2 mgd from that stream, average annual discharge immediately downstream would be reduced by about 20 percent. During average drought years and worst drought years, annual discharge immediately downstream of the dam would be reduced by about 38 percent and 61 percent, respectively. These percentage reductions in flow hold for only about one-half mile because of water added by tributaries. It must also be noted that these figures do not imply the same percentage reduction in downstream discharge during low-flow months.

Water withdrawals from a reservoir at the proposed War Fork and Steer Fork, 2.2 mgd site would not adversely affect downstream permitted water withdrawals, since there are none, neither existing nor pending, on either the downstream portion of War Fork or Station Camp Creek (to which it is tributary) all the way to the Kentucky River (Caldwell, 1999a).

Long-term flows to the karst region downstream of the proposed reservoir, where War Fork disappears underground for about a mile, would be reduced. This could slow the long-term rate at which limestone is dissolved and caves formed in that area (Walker, 1999).

Other potential impacts on surface and groundwater resources resulting from a dam and reservoir at the proposed War Fork and Steer Fork, 2.2 mgd site would be the same as those discussed in Section 3.2.2.2.1, War Fork and Steer Fork, of the DEIS. This section contains a discussion of

potential impacts to the Wild and Scenic Study River segment, located about 0.5 miles downstream of the proposed War Fork and Steer Fork, 2.2 mgd dam site.

3.2.2.2.8 Wood Creek Lake Pipeline

There are no site-specific potential impacts on surface and groundwater quality that would result from implementation of this alternative. Impacts on water resources resulting from the construction and operation of a water transmission pipeline are presented in Section 3.2.2.2, Environmental Consequences, Raw Water Transmission Main, of the DEIS. Refer to that section for this information. Impacts on surface and groundwater quality due to the Wood Creek Lake pipeline alternative would be independent of the size of the pipeline (1.33 mgd verses 2.19 mgd) constructed.

3.2.2.2.9 Lock 14 Pipeline

There are no site-specific potential impacts on surface and groundwater quality that would result from implementation of this alternative. Impacts on water resources resulting from the construction and operation of a water transmission pipeline are presented in Section 3.2.2.2, Environmental Consequences, Raw Water Transmission Main, of the DEIS. Refer to that section for this information. Impacts on surface and groundwater quality due to the Lock 14 pipeline alternative would be independent of the size of the pipeline (1.33 mgd verses 2.19 mgd) constructed.

3.2.2.2.10 Summary of Impacts

The following table lists the potential impacts on surface and groundwater resources resulting from the additional alternatives investigated in this FEIS.

Table 3.2.2-7. Summary of Impacts on Surface and Groundwater Resources From Reassessed Alternatives

Alternative	Impacts	Rating of Impacts
War Fork and Steer Fork, 1.3 mgd	• Temporarily degrade downstream water quality from turbidity and sedimentation during construction of the dam; • Temporarily degrade downstream water quality from POL/chemical spill(s) during storage and handling; • Long-term effect on downstream sediment transport; • Long-term reduction of downstream dissolved oxygen (DO) levels; • Long-term elevation of downstream summer water temperature; • Short-term reduction in downstream flows into the Wild and Scenic Study River segment during	• Moderately Significant • Insignificant • Insignificant • Moderately Significant • Moderately Significant • Moderately Significant

	impoundment; • Long-term reduction in downstream flows into the Study River segment from reservoir water withdrawals; • Impacts on downstream water withdrawals; • Permanent loss of existing wetlands; • Creation of new wetlands along shorelines and inflowing streams; • Creation of 65 acres of surface water; • Permanent conversion of waters of the United States from a flowing to a standing condition; • Long-term effect of surrounding land uses and lake-based recreation on reservoir water quality; • Temporarily degrade water quality from turbidity and sedimentation during construction of the water main.	• Insignificant • Insignificant • Insignificant • Insignificant • Moderately Significant • Moderately Significant • Insignificant • Insignificant
War Fork and Steer Fork, 2.2 mgd	• Temporarily degrade downstream water quality from turbidity and sedimentation during construction of the dam; • Temporarily degrade downstream water quality from POL/chemical spill(s) during storage and handling; • Long-term effect on downstream sediment transport; • Long-term reduction of downstream DO levels; • Long-term elevation of downstream summer water temperature; • Short-term reduction in downstream flows into the Wild and Scenic Study River segment during impoundment; • Long-term reduction in downstream flows into the Study River segment from reservoir water withdrawals; • Impacts on downstream water withdrawals; • Permanent loss of existing wetlands; • Creation of new wetlands along shorelines and inflowing streams; • Creation of 88 acres of surface water; • Permanent conversion of waters of the United States from a flowing to a standing condition; • Long-term effect of surrounding land uses and lake-based recreation on reservoir water quality;	• Moderately Significant • Insignificant • Insignificant • Moderately Significant • Moderately Significant • Moderately Significant • Moderately Significant • Insignificant • Insignificant • Insignificant • Moderately Significant • Moderately Significant • Insignificant

	• Temporarily degrade water quality from turbidity and sedimentation during construction of the water main.	• Insignificant
Wood Creek Lake Pipeline	• Temporarily degrade water quality from turbidity and sedimentation during stream crossings; • Temporarily degrade water quality from POL/chemical spill(s) during storage and handling; and • Permanent loss of existing wetlands.	• Moderately Significant • Insignificant • Insignificant
Lock 14 Pipeline	• Temporarily degrade water quality from turbidity and sedimentation during stream crossings; • Temporarily degrade water quality from POL/chemical spill(s) during storage and handling; and • Permanent loss of existing wetlands.	• Moderately Significant • Insignificant • Insignificant

3.2.2.3 Mitigation

There are no changes to this section for the FEIS. Refer to Section 3.2.2.3, Mitigation, for a discussion on measures which could minimize adverse impacts on surface and groundwater resources due to implementation of the proposed action.